2ND LAPS USER WORKSHOP SUMMARY

WORKSHOP LOGISTICS

- **Co-organized by OCWWS/NWS** & Forecast Applications Branch (FAB) of **GSD**
- Held 23-25 Oct 2012 at ESRL in DSRC, Boulder, Colorado
- **75 participants**, including 23 remote
  - NOAA 31
    - GSD; NWS OCWWS, OST, Regions, Training Center
  - International 17
    - China, Finland, Greece, Italy, Korea, Serbia
  - Academia 15
    - NCAR, Universities
  - Private Sector 9
    - AlphaTRAC, Radiometrics, Telvent, Toyota Racing, Vaisala, WDT
  - Other agencies 5
    - DOD, NASA
- **38 presentations**, including 6 posters
- 2 sessions of **Working Group discussions**

HIGHLIGHTS

- **Attendance more than doubled** compared to 1st meeting
  - Broad spectrum of users & developers
- Continued strong interest in **unique features** of LAPS
  - Quality, portability, speed, & ease of use
- LAPS **used operationally by more than 20 agencies**
  - Federal, state, private, international
- **Variational version** of LAPS introduced
  - Competitive with nowcasting methods
- **Community development** effort
  - Contributions from multiple national / international groups
- **Major scientific impact**
  - ~400 citations to 30 refereed NOAA LAPS publications
  - 4,000+ citations to 400+ total NOAA LAPS publications

MAJOR RECOMMENDATIONS

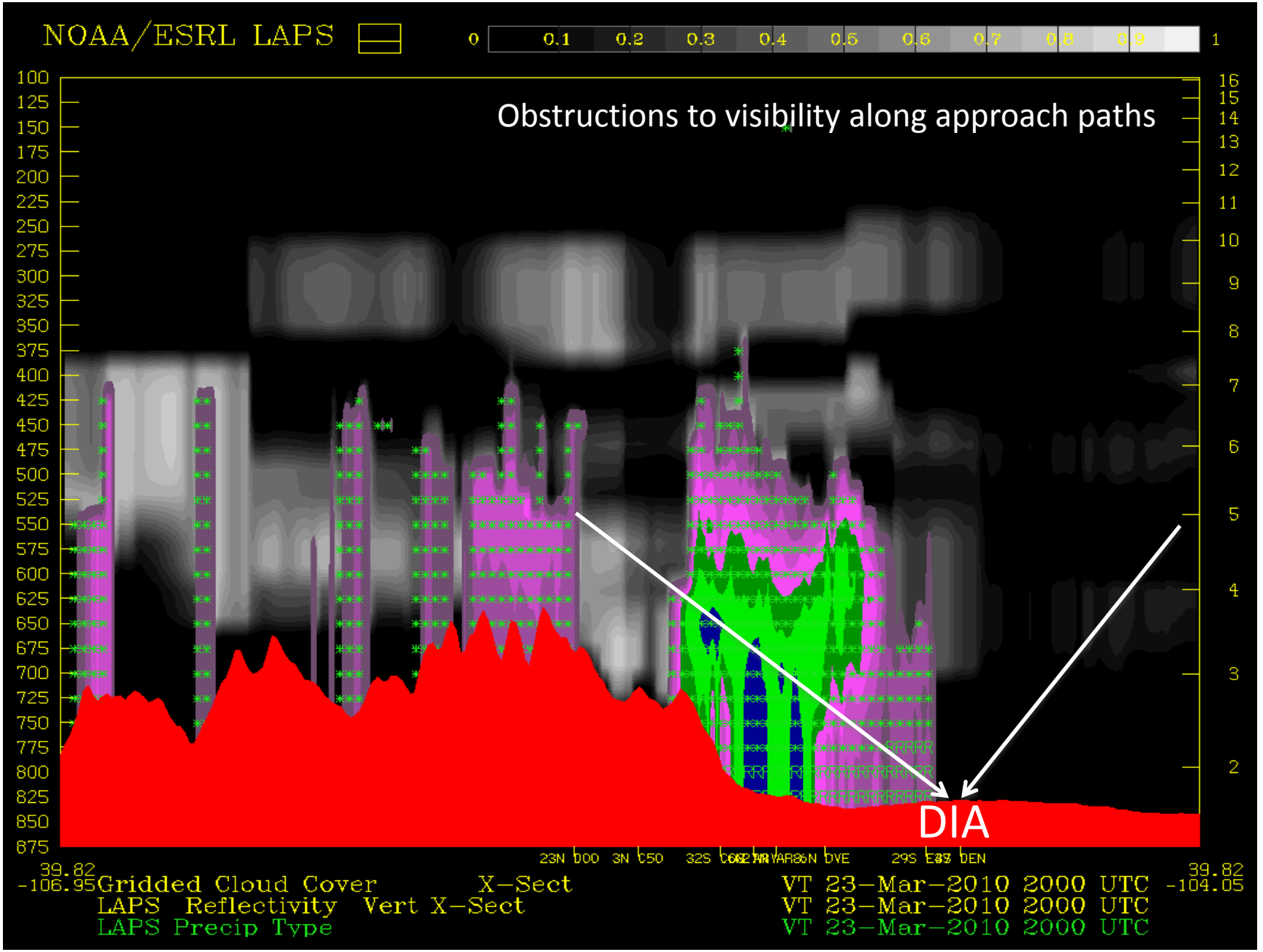
- **Accelerate development & implementation** of
  - Variational cloud / convection analysis (“hot-start”), dynamical balance, & terrain following coordinate
- **Enhance community development efforts** via
  - Use of version control & code repositories
  - Recommended rules of engagement
- **Develop wizards** for installation, data ingest, & verification
  - In AWIPS2 environment - Make AWIPS2 available to community
- Make the use of new **local observations** easier
  - Build globally comprehensive data ingest capabilities

MAJOR RECOMMENDATIONS - 2

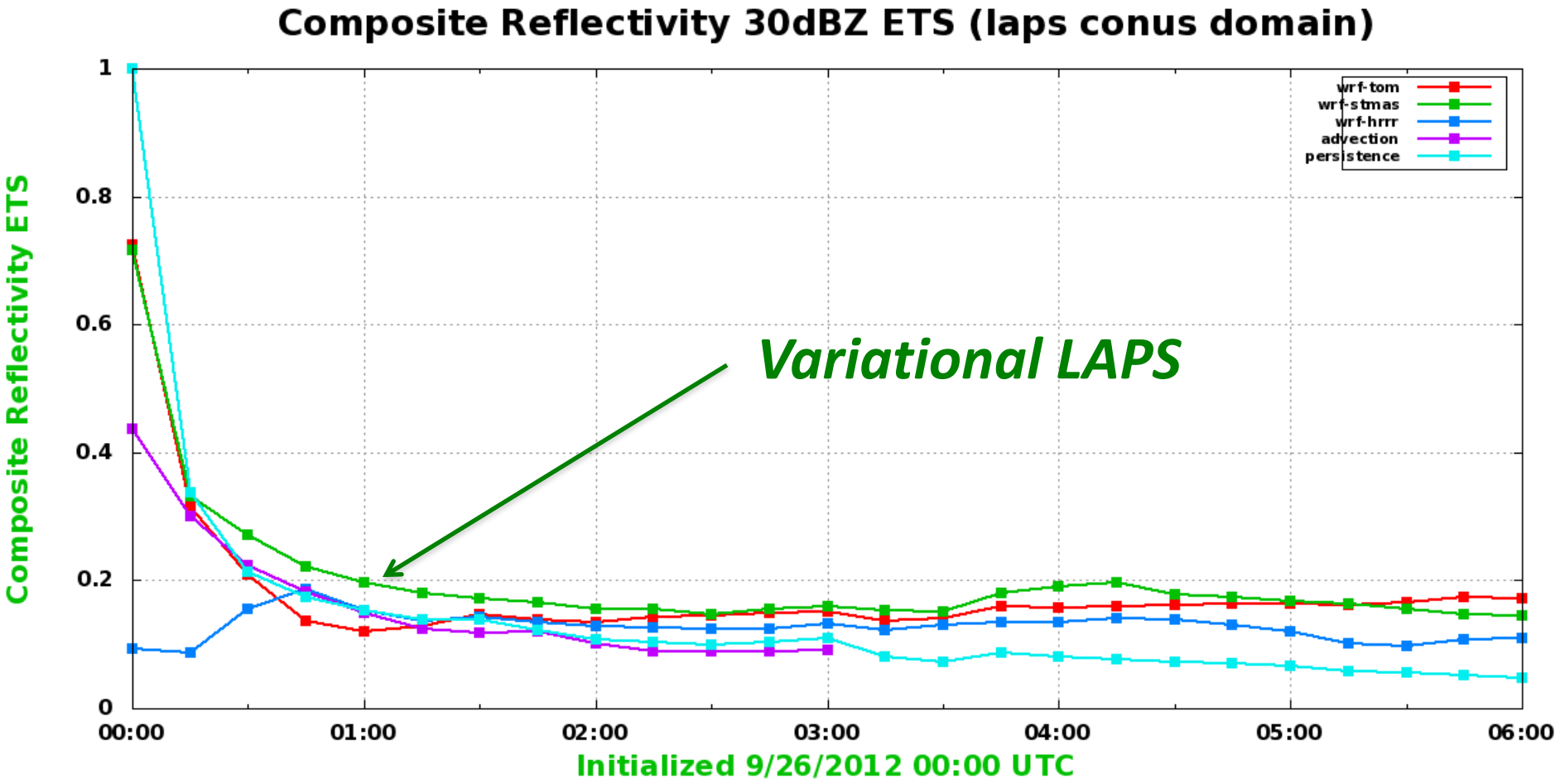
- **Form LAPS User Group** (LUG)
  - Shares good practices, advocates
- **Define Change Control Management**
  - Formal evaluations with LUG
- **Internationally coordinated development** of LAPS
  - Coordinated planning, visitor exchange, etc
- **Next workshop in 2014**
  - Regional workshops in Asia and/or Europe in 2013?

CLOUD / REFLECTIVITY / PRECIP TYPE (1KM ANALYSIS)

LOOP

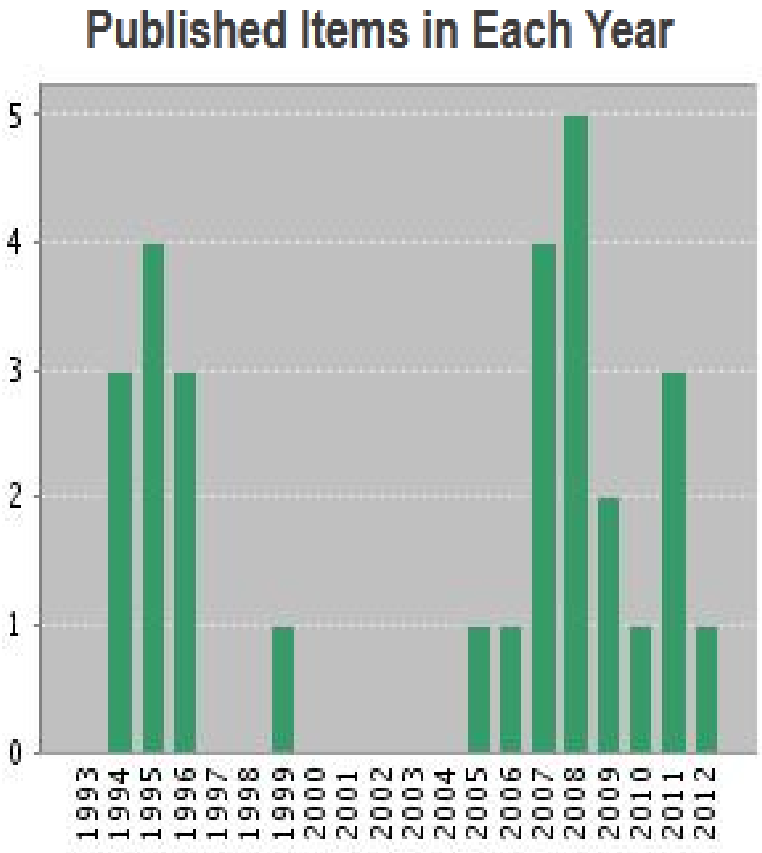


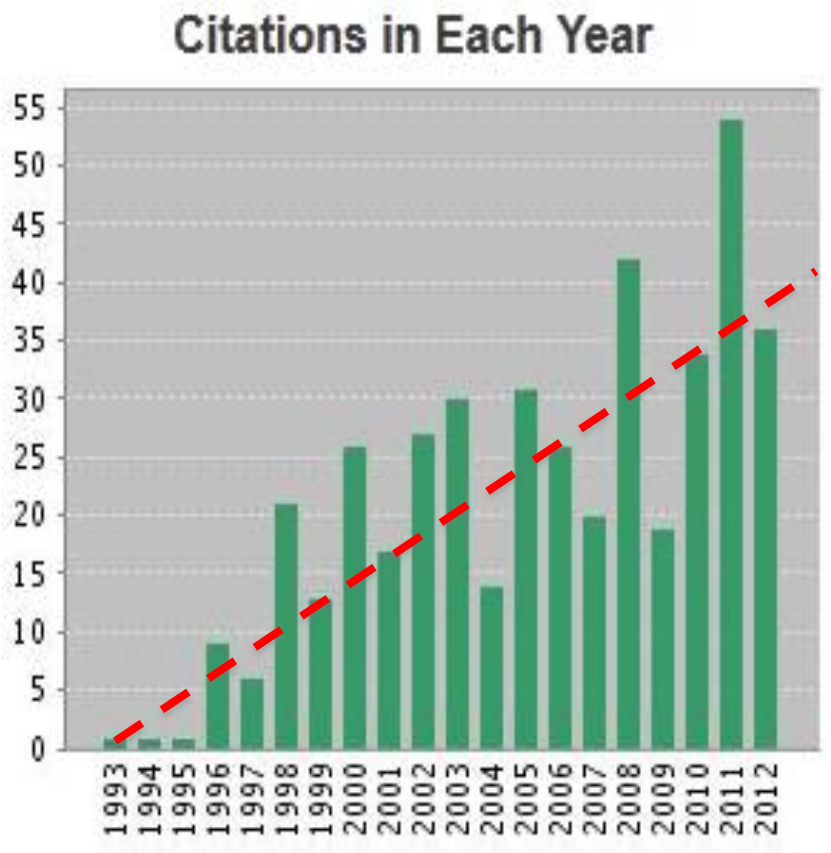
WARN ON FORECASTING (WOF) – ARE WE GETTING THERE?



- On occasion, ***variational LAPS*** superior to ***advection*** and ***persistence***

LAPS SCIENTIFIC IMPACT – REFEREED PAPERS





- **30 refereed publications** by GSD/NOAA
  - 1-2 refereed papers per year

- **391 citations** in refereed papers
  - *~ 40 / year recently*

RECOMMENDATIONS - DEVELOPMENT

Accelerate (stop) development of variational (traditional) LAPS
Continue support of traditional version until users switch (2 yrs)

- **Variational cloud analysis**
  - Biggest expected user impact?
- **Dynamical balance**
  - Consistency with model dynamics / physics - weak or strong constraint?
- **Terrain following coordinate**
  - Leads to unified & improved surface / 3D analysis
- Use of first guess
  - Cycling with LAPS analysis needed
  - Add land surface DA capability
- Observation nudging
  - Role in variational framework? If 4DVAR not available?
- **Error (co-)variance estimation**
  - Observations, analysis, first guess
    - Address systematic errors
  - Use independent observations & other methods for assessment
    - Team up with NESDIS & NASA
  - Variational QC
    - Study methodologies

RECOMMENDATIONS - COMMUNITY DEVELOPMENT

- **Code repository**
  - Can LAPS version control repository be read open to all?
  - Can branches be write open to trusted collaborators?
  - LAPS repository must be linked with NOAA DA repository
    - Part of it or components shared – e.g., CRTM, forward models
- **Rules of engagement** – must acknowledge before downloading
  - All changes to be fed back to “trunk” except user specific changes
    - Including documentation
    - Will benefit all
  - No redistribution of codes
  - Acknowledgement of LAPS team, including external partners
    - Consider WaveWatch-3 example
- **Testing protocols**
  - Test cases over US & elsewhere, hosted by GSD & community
    - Assess improvements, proper installation, scientific studies, etc
  - Regression testing by 3rd party (DTC)?

RECOMMENDATIONS – EASE OF USE

- **Install / upgrade / test Wizard for AWIPS2**
  - Will AWIPS2 be available to external user community?
  - Can UNIDATA distribute LAPS?

- **Wizard to QC & ingest observational data**
  - Seek community input on format for new datasets
    - Consider / coordinate with GSI approach
  - Do all new data need to be converted data to be used in LAPS?
    - Share converters

- **Enhance LAPS verification system** – linked with data ingest & QC
  - Can regression testing be done automatically?
  - Expand via MET or other community packages?

- **Parallelization / optimization**
  - Pre/post-processing routines
  - Variational minimization routine

- Can Boundary Conditions be adjusted automatically? MSG ingest?

RECOMMENDATIONS – OBSERVATIONS

Acquire, ingest, prepare forward model for all new local data

Prepares LAPS for global applications

- **In-situ**
  - MDCARS/AMDAR
  - GPS Signal delay/refractivity
  - Sonic anemometers – via MADIS or otherwise?

- **Satellites**
  - Radiances
    - Use of CRTM
  - Polar orbit (AIRS)
  - COSMIC GPS radio occultation – good vertical, poor horizontal resolution
  - LIDAR - data source for backscattering & radial velocity
  - Lightning data – CSV or NetCDF?
  - Scatterometer - through LSO or NetCDF interface?

RECOMMENDATIONS - OPERATIONS

- **Form LAPS User Group** (champions, LUG)
  - Representatives from each region and application area
    - Link with NWS training
  - Promotes and advocates use of LAPS – shares best practices
  - Communicates user needs to developers
- **Define Change Control Management**
  - Once per year implementation – use version number
  - Formal pre-implementation evaluation
    - Near real time hrly CONUS analysis, 4/day 6hr forecast, for ~30 days
      - Objective verification by GSD – Comparison w. other NWP systems - RTMA
      - Subjective evaluation by Regions / LUG
  - Experimental version made available to LUG / NWS champions
    - Special local application tests
- **Implement variational version of LAPS** as default
  - Prepare documentation (GSD), Modify training (NWS)
  - Upgrade software in AWIPS2
- Use **Testbeds** to test new applications for LAPS
  - Satellite Proving Ground – Rapid synthesis of all observational info
  - HWT – severe weather, HMT – flash floods
  - Use verification as quality alerts

RECOMMENDATIONS – USER SUPPORT

- **Code documentation**
  - For users with different levels of knowledge – basic vs. advanced
  - Modernize format – Tim Brown?

- Enhance **LAPS Forum**
  - FAQs captured to benefit all
  - Make it easier to search

- Maintain / expand **LAPS Tutorial / Training**
  - For basic, sophisticated user, & forecaster
  - Separate what's general from what's specific for NWS
    - NWS will make training available to general community
  - Role of FAB, GSD, NWS Training Center, etc

- **Outreach**
  - Develop LAPS Public Relations brochure
    - Flyer plus Workshop reports?
  - Engage with High Schools to run LAPS

FOLLOW-UP

- **Publications**
  - Workshop summary in BAMS
  - Special journal issue with LAPS papers?
    - How many interested authors?

- **Next Workshops**
  - Main workshops to be held biannually in Boulder
    - Next in fall 2014
    - Focus on cloud analysis?
  - Regional LAPS Workshops in years in between
    - Asia – offer from Heavy Rain Institute
    - Europe – Summer of 2013?

- **Long-term partnership** among LAPS developers
  - Coordinated planning, visitor exchange, joint proposals

- **Thank you** all for your contributions!